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[Document] Specification

[Title of the invention]

NON-CHARGING RESIN COMPOSITE AND METHOD FOR MANUFACTURING THE SAME

[Claims]

[Claim 1] A resin composite material in which a component containing a metal element is present at the surface of a resin base, which is obtained by using a resin base treated with ion exchange group introduction agent, and treating its surface with a liquid containing metal ions to introduce metal ions, and then converting said metal ions, said non-charging resin composite material being characterized in that the ratio of the surface resistance of said resin composite material to the resistivity of said component containing metal element is 10^{12} to 10^{17} (1/□·cm).

[Claim 2] The non-charging resin composite material according to Claim 1, wherein the surface resistance of the resin composite material is 10^{6}-10^{11} Ω/□.

[Claim 3] The non-charging resin composite material according to Claim 1 or 2, wherein the component containing metal element is selected from a group comprising metals, metal arsenides, metal antimonides, metal selenides, metal tellurides, metal sulfides and metal oxides.

[Claim 4] The non-charging resin composite material according to any of Claims 1-3, wherein the metal element is a metal element selected from V, Cr, Mn, Fe, Co, Ni, Cu, Ga, As, Se, Mo, Ru, Rh, Pd, Ag, Cd, In, Sb, Te, Os, Ir, Pt, Au, Hg, Pb, Bi and mixtures thereof.

[Claim 5] The non-charging resin composite material according to any of Claims 1-4, wherein the resin is a resin selected from a group comprising epoxy resin, polyimide resin, vinyl resin, phenol resin, nylon resin, polyphenylene ether resin, polypropylene resin, fluorine-based resin, ABS resin and mixtures thereof.

[Claim 6] A method for manufacturing the non-charging resin composite material according to any of Claims 1-5, which comprises (1) a process wherein resin base is treated with ion exchange group introduction agent, (2) a process wherein treatment is carried out with a liquid containing metal ions, and (3) a process wherein component

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~~containing metal element is introduced at the surface of the resin by a conversion treatment.~~

~~[Detailed description of the invention]~~

~~[0001]~~

~~[~~Technological field of the invention~~]~~

[0001] The present invention relates to a non-charging resin composite material wherein a component containing metal element is present at the surface of a resin base, and a method for manufacturing the aforementioned non-charging resin composite material.

~~[0002]~~

~~[~~Prior art~~]~~

[0002] Resin bases constituting electronic parts that are composed of epoxy resin, polyimide resin and other such resins, and bases composed of resins such as ABS resin, methyl methacrylate, polyethylene and vinyl chloride are poor conductors of electricity, and thus readily charge due to friction, etc. With charged bases, a base can be readily marred due to discharge of static electricity arising from charging, and dirt and durst tend to adhere to the base due to static electricity. This makes processing of said resin base difficult, which is a particularly serious problem in the manufacture of precision parts that cannot permit the presence of marring, fine dirt or dust on the base. In addition, there are many products in which the adhesion of dust and dirt due to charging is undesirable in post-processed resin products.

[0003] The best way to prevent charging in resin bases is to prevent the isolation of electric charge, but there are currently many aspects of the charging mechanism that are unclear, and a solution to the problem is thus difficult. In order to reduce local electric fields formed due to charge isolation, charging is prevented by covering the surface with a high-dielectric material, by ionizing air in the vicinity with the objective of increasing isolated charge leak rate, or coating the surface with a substance having a large dielectric constant~~ [sic; repeated]~~.

~~[0003]~~

[0004] Examples of methods for preventing charging are temporary charging prevention methods and long-term charging prevention methods. Examples of temporary charge-~~elimination~~ prevention methods, are air ionization methods and methods in which a material is coated with a surfactant or substance having surfactant as primary component, thereby increasing moisture absorption at the base surface, and decreasing the resistance of the surface. These methods, however, are lacking in persistence, and are used only with the objective of manifesting effects for a determinate period of time in order to eliminate processing problems during processing.

[0005] An example of a long-term charge prevention method is a method in which conductive substance such as silver or copper powder is introduced into the resin base. A mode for introduction of conductive substances into resin base is a method in which conducive substance is incorporated into the resin base. In such cases, characteristics that are intrinsic to the resin base can be lost, such as the low conductivity that is characteristic of resin bases. Grain size and distribution of the metal are important factors in incorporating metals while maintaining the characteristics of a resin base, but it is extremely difficult to obtain a resin base having the desired properties while admixing metal and controlling these factors.

~~[0004]~~

[0006] Another mode of introducing conductive substance into a resin base are methods in which metal is introduced at the surface of the resin base. Examples of this type of introduction method include metal vapor deposition, casting methods and plating methods. When introducing metal at the surface of the resin base, there are problems with the amount of metal introduced related to binding between the metal and the resin base, but with these methods, it is not always necessary to introduce metal with good binding properties. In addition, it is difficult to introduce metal at an amount whereby charging is sufficiently eliminated without increasing the conductivity at the base surface above a certain level.

~~[0005]~~

[0007] For example, when the resin constituting the resin base is polyimide resin, it is difficult to form bumps that will have an anchoring effect, and so providing sufficient

binding is more difficult than with other resins. In addition, with ABS resin, round pits are formed by the preferential elution of butadiene particles during etching with chromic acid-sulfuric acid mixed solution, and so it is possible to improve binding by providing anchoring effects. With epoxy resin or polyimide resin, it is possible to improve binding by providing non-uniformities at the surface by etching the epoxy resin with permanganic acid solution, etc. However, even when metal is introduced by widely-used electroless plating carried out after etching the surface as a pretreatment, it is extremely difficult to introduce metal in extremely small amounts so that charging can be prevented without increasing the conductivity above a certain level.

~~[0006]~~

~~[~~

Problems to be solved by the invention~~]~~

[0008] For this reason, there is strong demand for a method whereby component containing extremely small amounts of metal element is introduced at the surface of the resin base at levels at which charging of the resin base can be prevented without increasing the low conductivity intrinsic to the resin base.

[0009] In addition, a non-charging resin composite material is desired that has component containing extremely small amounts of metal element at the surface of a resin base at levels at which charging of the resin base can be prevented without increasing the low conductivity intrinsic to the resin base.

~~[0007]~~

Summary of the Invention

[0010] The present invention was developed in light of this state of affairs, and has the objective of offering a resin composite material wherein a component containing metal element is present at the surface of a base resin in a condition that produces excellent binding, and in an amount such that charging of the resin base can be prevented without increasing the resin base surface conductivity above a certain level. In addition, the invention has the objective of offering a method for forming the aforementioned resin composite material by means of treatment with an ion exchange group introduction agent,

and by means of a comparatively simple treatment process that employs a liquid system containing a metal element.

~~[0008]~~

~~[Means for solving the problems]~~

[0011] The present invention offers a non-charging resin composite material that is obtained by using a liquid containing metal ions to treat the surface of a resin base that has been treated with ion exchange group introduction agent, thereby introducing metal ions, followed by conversion of said metal ions, where component containing metal element with a resistivity within a specific range is present at a determinate amount at the surface of the resin base so that a degree of conductivity is produced that can prevent charging without increasing the conductivity intrinsic to the resin base above a certain level.

[0012] In addition, the present invention offers a method for forming the aforementioned non-charging resin composite material, which comprises (1) ~~a process wherein~~treating a resin base ~~is treated~~ with ion exchange group introduction agent, (2) ~~a process wherein treatment is carried out~~ treating a resin base with a liquid containing metal ions, and (3) ~~a process wherein~~introducing a component containing metal element ~~is introduced~~ at the surface of the resin by a conversion treatment.

~~[0009]~~

~~Mode of implementation of the invention~~

Detailed Description of the Invention

[0013] The present invention offers a resin composite material in which a component containing a metal element is present at the surface of a resin base, which is obtained by using a resin base treated with ion exchange group introduction agent, and treating its surface with a liquid containing metal ions to introduce metal ions, and then converting said metal ions, said non-charging resin composite material being characterized in that the ratio of the surface resistance of said resin composite material to the resistivity of said component containing metal element is 10^{12} to 10^{17} ($1/\square \cdot cm$).